

TRAFFIC SPEED REPORT NO. 76
TRUCK WEIGHT-SPEED STUDY

JANUARY, 1963

NO. 7

**Joint
Highway
Research
Project**

**PURDUE UNIVERSITY
LAFAYETTE INDIANA**

by
D.E. DILLARD

Progress Report

TRAFFIC SPEED REPORT NO. 76
TRUCK WEIGHT-SPEED STUDY

TO: K. B. Woods, Director
Joint Highway Research Project

January 30 1963

FROM: H. L. Michael, Associate Director
Joint Highway Research Project

File: 8-3-4
Project: C-36-10D

Attached is Traffic Speed Report No. 76 which is the 1962 Truck Weight-Speed Study. This annual study which is performed in cooperation with the State Highway Planning Survey Unit of the Indiana State Highway Commission was conducted by Mr. David E. Dillard of our staff.

A summary of the results of similar studies made in previous years and these data for 1962 indicate that the trend of average speed and weight of trucks have increased gradually during the past decade. The 85th percentile speed of these trucks, however, has slightly decreased since a high was reached in 1959-60. There is also an indication of some correlation between vehicle speed and vehicle weight.

Copies of this report will be distributed to the Highway Planning Unit, the Bureau of Public Roads and the Indiana State Police. The report is submitted for the record and for such release.

Respectfully submitted,

Harold L. Michael
Harold L. Michael, Secretary

HLM:kmc

Attachment

Copy:

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TRAFFIC SPEED REPORT NO. 76

TRUCK WEIGHT-SPEED STUDY

by

David E. Dillard
Graduate Assistant

Joint Highway Research Project

File No: 8-3-4

Project No: C-56-100

Performed in Cooperation

with

The State Highway Planning Survey

Indiana State Highway Commission

August 21, 22, 24, 30
September 5, 6, 7, 12, 17
1962

Purdue University
Lafayette, Indiana

January 30, 1963

TRAFFIC SPEED REPORT NO. 76

TRUCK WEIGHT - SPEED STUDY

Introduction

The eighteenth annual truck weight-speed study was conducted during the months of August and September 1962 by the Joint Highway Research Project of Purdue University in cooperation with the Highway Planning Survey Unit of the Indiana State Highway Commission. The Highway Planning Survey Unit makes annual studies of truck weights, size, material hauled, etc. at twenty permanent truck-weight stations located throughout the state. The truck weight-speed study matches the weight of a truck, obtained by the Planning Unit with portable loadometer scales, and the observed speed of the same vehicle as recorded at a nearby speed station. This provides the basis for a correlation of truck speeds with truck weights.

Data from nine truck weight stations were used for the truck weight-speed study. These stations are shown on Figure 1 and are further described as follows:

<u>Station</u>	<u>Highway</u>	<u>Location</u>	<u>Date of obs.</u>	<u>No. of Lanes</u>
53B	U.S.31	0.2 mi S of Southport Road	Aug. 21	4
75	U.S.41	0.2 mi S of U.S.41 Bus.	Aug. 22	4
81	U.S.150	0.5 mi E of S.R.56	Aug. 24	2
45B	S.R.67	1.0 mi SW of Muncie	Aug. 30	2
5	U.S.30	1.3 mi E of Bourbon	Sept. 5	2
1	U.S.31	0.2 mi S of U.S.6	Sept. 6	2
2	U.S.20	0.3 mi W of S.R.2	Sept. 7	4
14	U.S.41	0.5 mi S of S.R.2	Sept. 12	4
42	U.S.52	at Jct. of S.R.38	Sept. 17	4

The speed observations were made on level, tangent sections of highway between one and three miles from the weight station. In all cases, sufficient distance was allowed for the trucks to regain normal cruising speed while minimizing opportunities for the vehicles to turn off the highway.

The speed data were collected by the author and Mr. John Whitworth. The analysis was performed by the author with the aid of members of the Traffic Engineering Laboratory staff.

Equipment and Field Procedure

The speed observations were made with an Electromatic Radar Speed Meter reading directly in miles per hour. The radar was checked for accuracy prior to field use. While in the field, accuracy of radar readings was verified by frequent checks with a 60-mile per hour tuning fork. The radar unit was placed upon a box approximately four feet from the edge of the pavement and was oriented at a small angle with the direction of traffic flow. Complete concealment of the equipment is not practical on modern highways having adequate shoulder width. To lessen the effect of driver observation of a speed meter, the meter set up was covered by a large wooden packing box with a color that blended with the surrounding landscape. A 100 foot extension cord permitted the observer and indicator unit to be out-of-sight. There was no apparent change in speed under these conditions as traffic approached the speed station.

For use in this study only normal highway truck speeds were desired. Therefore, observations were made only on "free-flowing" trucks - that is, trucks not hampered by other traffic or by a change in speed resulting from a turn or stop. This limitation resulted in obtaining a small amount of data on low capacity highways.

The speed trailers were operating during the same period as the truck weights studies. The two last studies showed that 17 percent of trucks during the study period were in the 100,000 to 150,000 pound weight class. The other studies showed that 10 percent of trucks were in the 100,000 to 150,000 pound weight class.

The following table shows the results of the study. The table shows the number of trucks in each weight class, the average speed, and the average weight. The table also shows the percentage of trucks in each weight class. The table shows that the average speed of trucks in the 100,000 to 150,000 pound weight class is 10.6 miles per hour. The average weight of trucks in this weight class is 112,000 pounds. The percentage of trucks in this weight class is 17 percent.

Trucks in the 100,000 to 150,000 pound weight class			
No. of vehicles	10	10	10
Average speed (mph)	10.6	10.6	10.6
Average weight (lbs.)	112,000	112,000	112,000

Single-unit trucks over 5,000 pounds gross weight			
No. of vehicles	10	10	10
Average speed (mph)	10.6	10.6	10.6
Average weight (lbs.)	112,000	112,000	112,000

Multiple-units (truck-trailer) -

No. of vehicles observed	441	638	1079
Average speed (mph)	47.3	50.6	49.2
Average weight (lbs.)	43,200	42,300	42,700

Table III reveals that 3.4% of the light trucks exceeded the legal 65 mph speed limits and only 1.1% exceeded an "enforceable" speed limit of 70 mph. On two-lane highways, slightly over 26% of the heavy trucks exceeded the legal limit of 50 mph. The percentage exceeding an enforceable speed limit (55 mph) was 11.2% for heavy single-units and 6.7% for multi-units. On four-lane highways, 18.2% of the heavy single-units and 23.4% of the multi-units exceeded the legal 55 mph speed limit. On this type of highway, only 5.9% of the heavy trucks and 3.6% of the truck-trailer combinations traveled faster than a 60 mph "enforceable" speed.

A comparison of average speeds and weights for the last fourteen years is presented in Table IV. The average speed of single unit trucks has shown a tendency to increase since 1949. During the last few years, the average weights have also apparently increased from less than 9,000 lbs. to above 10,000 lbs. The average speed and weight of multi-unit trucks have also increased during this period of time. Truck-trailer weights appear to have a fairly constant upward trend.

The cumulative frequency distribution curves (Figures 2, 3, and 4) indicate that multi-unit trucks travel with less speed variation between trucks than the single-unit vehicles. This is disclosed by the steepness of the central portion of the frequency curve and the narrower speed differential between the 15th and 85th percentile. The group exhibiting the greatest variability in speeds is the light single-unit trucks.

A plot of average trucks speed versus truck weights as obtained in the 1962 study produced the diagrams of Figures 5 and 6. The points

plotted are average speeds for a weight classification while the numbers represent the number of vehicles observed in that classification. The lines were fitted to the plotted data using the observed fit technique. The slope of the lines suggests the possible relationship between truck weight and truck speed.

Figures 7 and 8 are graphical portraits of the trend in 85th percentile truck speed 1953-1962 for two-lane and four-lane highways, respectively. The trend curves were fitted to the data by the observed fit technique so as to give smooth curves. Although average speeds have been increasing rather steadily for all truck types (see Table IV), the 85th percentile speed for each truck type has decreased since 1959-1960.

The data reported here are submitted primarily for the record and are not completely analyzed. The data will be submitted to the Bureau of Public Roads for use by them in their continuing speed-weight studies in the United States and the data will be added to the speed trend and speed-weight trend data of the Joint Highway Research Project.

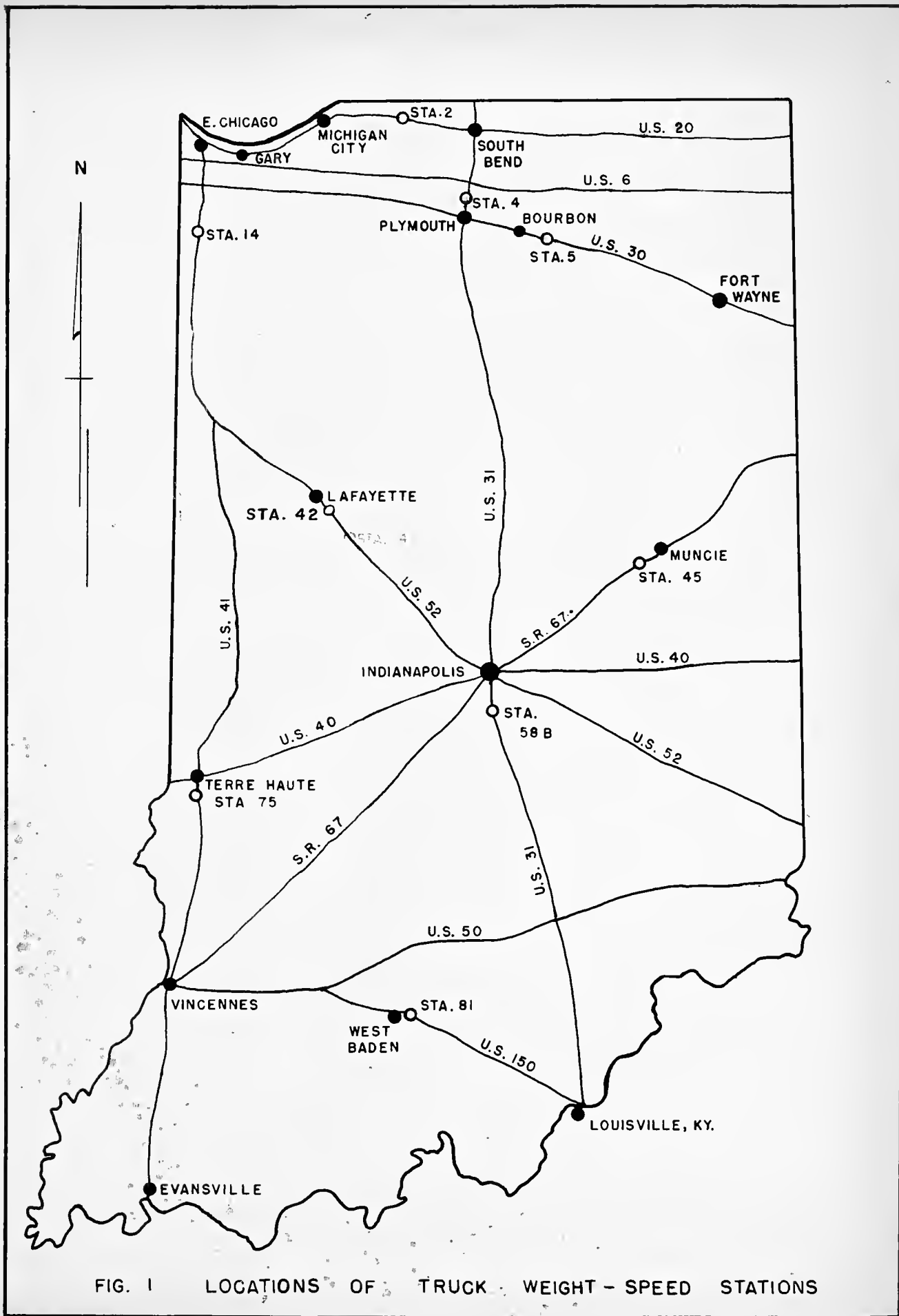


FIG. 1 LOCATIONS OF TRUCK WEIGHT - SPEED STATIONS

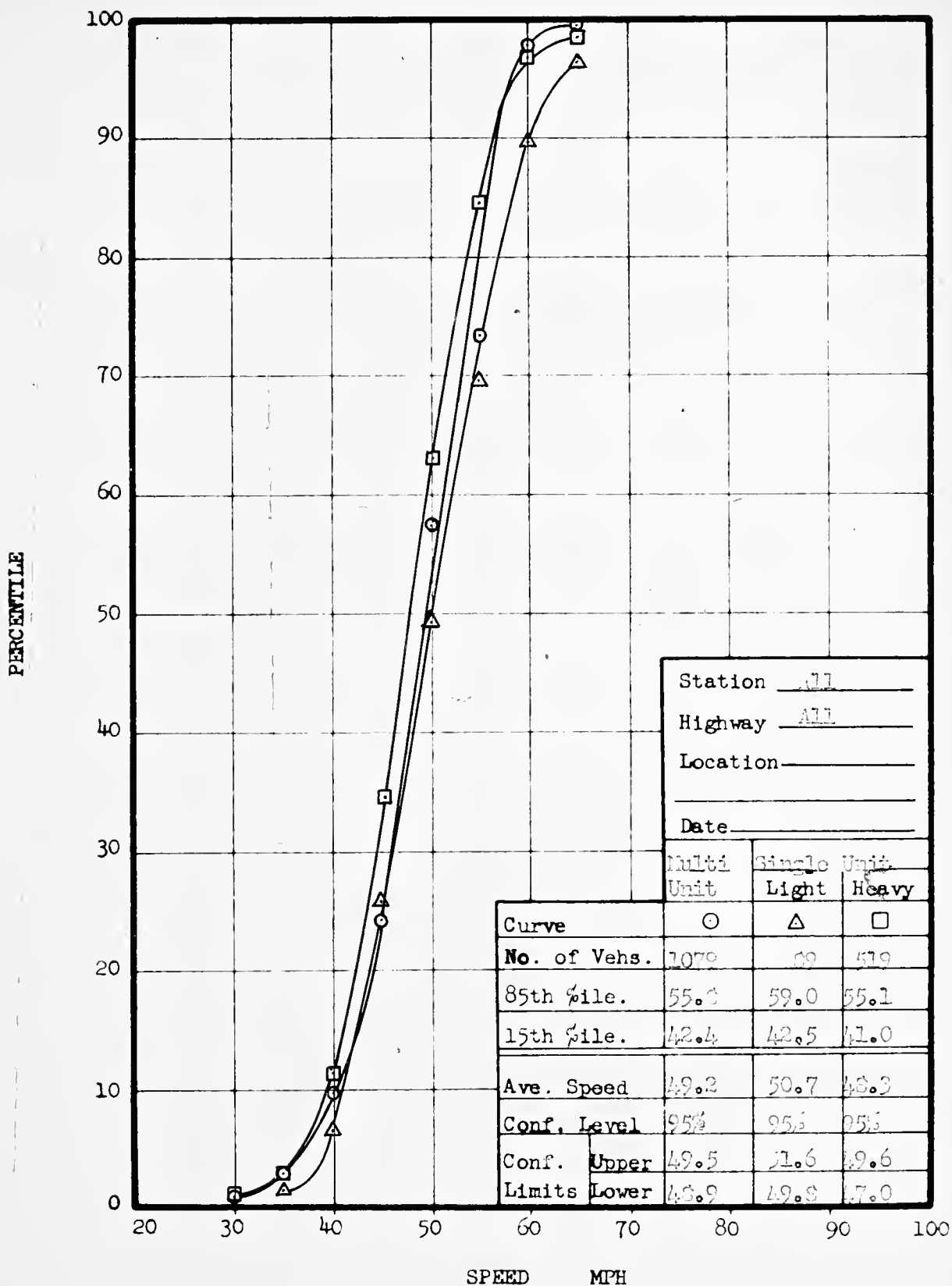


FIGURE 2. CUMULATIVE FREQUENCY CURVES FOR ALL HIGHWAYS

PERCENTILE

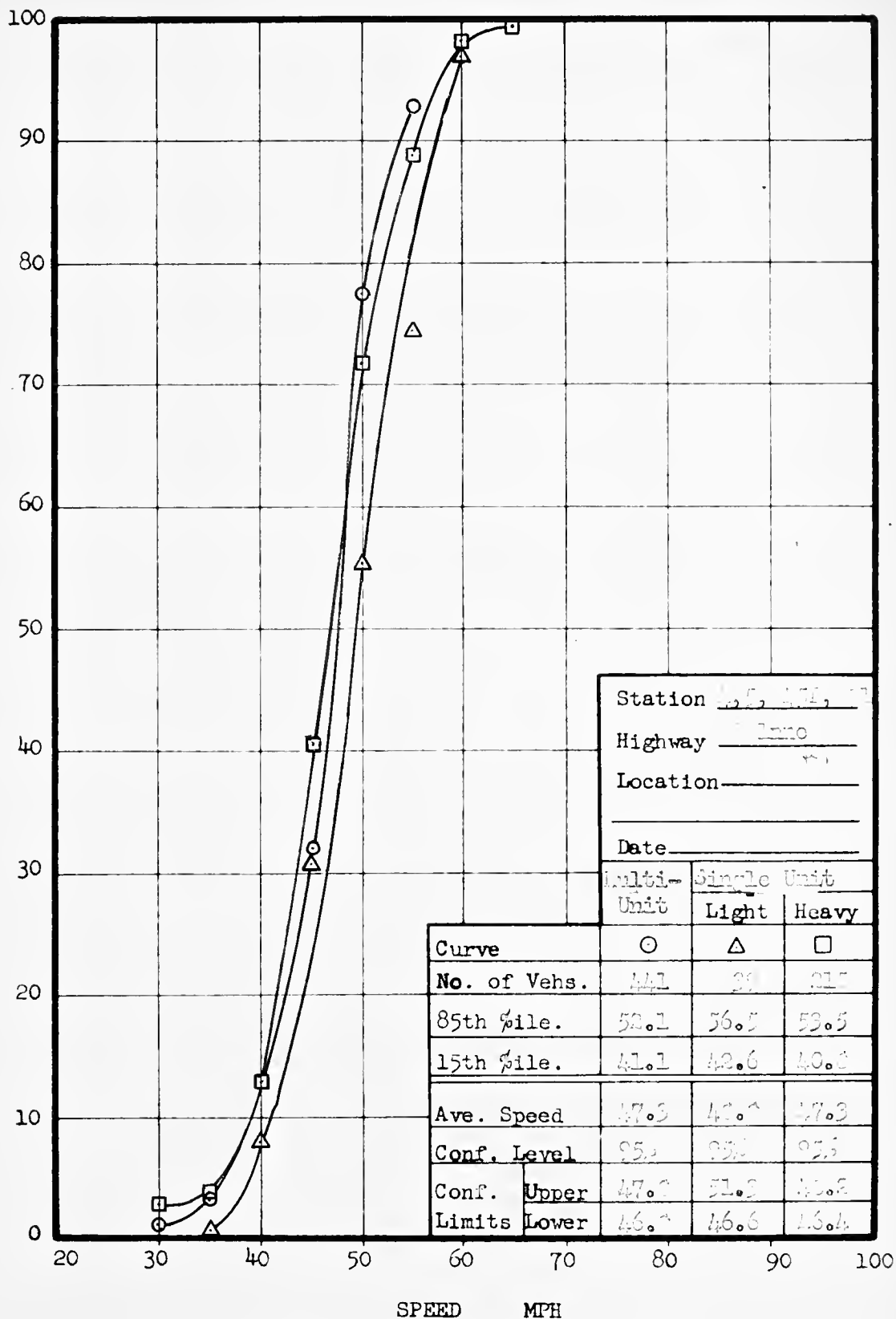


FIGURE 3. CUMULATIVE FREQUENCY CURVES FOR TWO-LANE HIGHWAYS

PERCENTILE

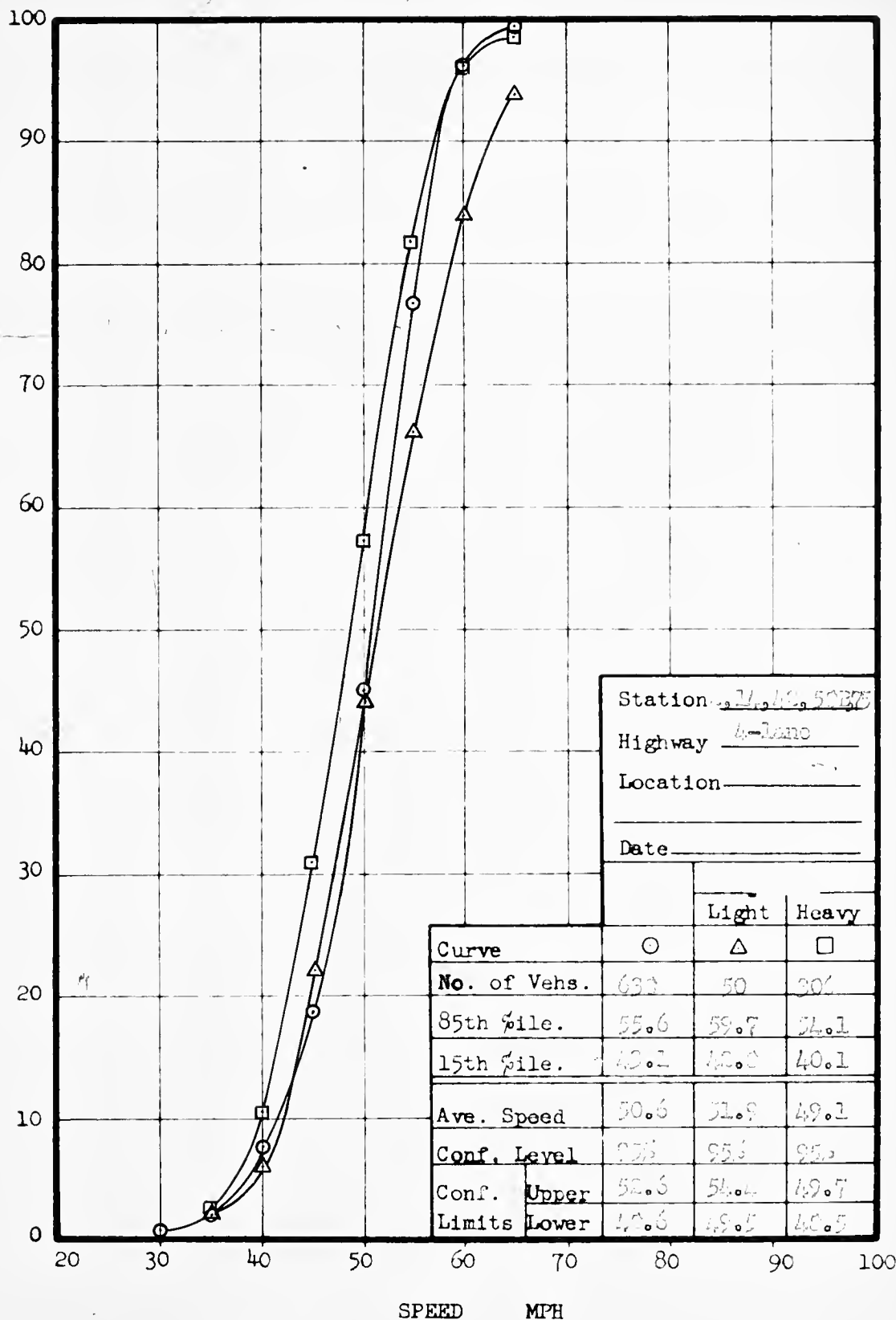


FIGURE 4. CUMULATIVE FREQUENCY CURVES FOR FOUR-LANE HIGHWAYS

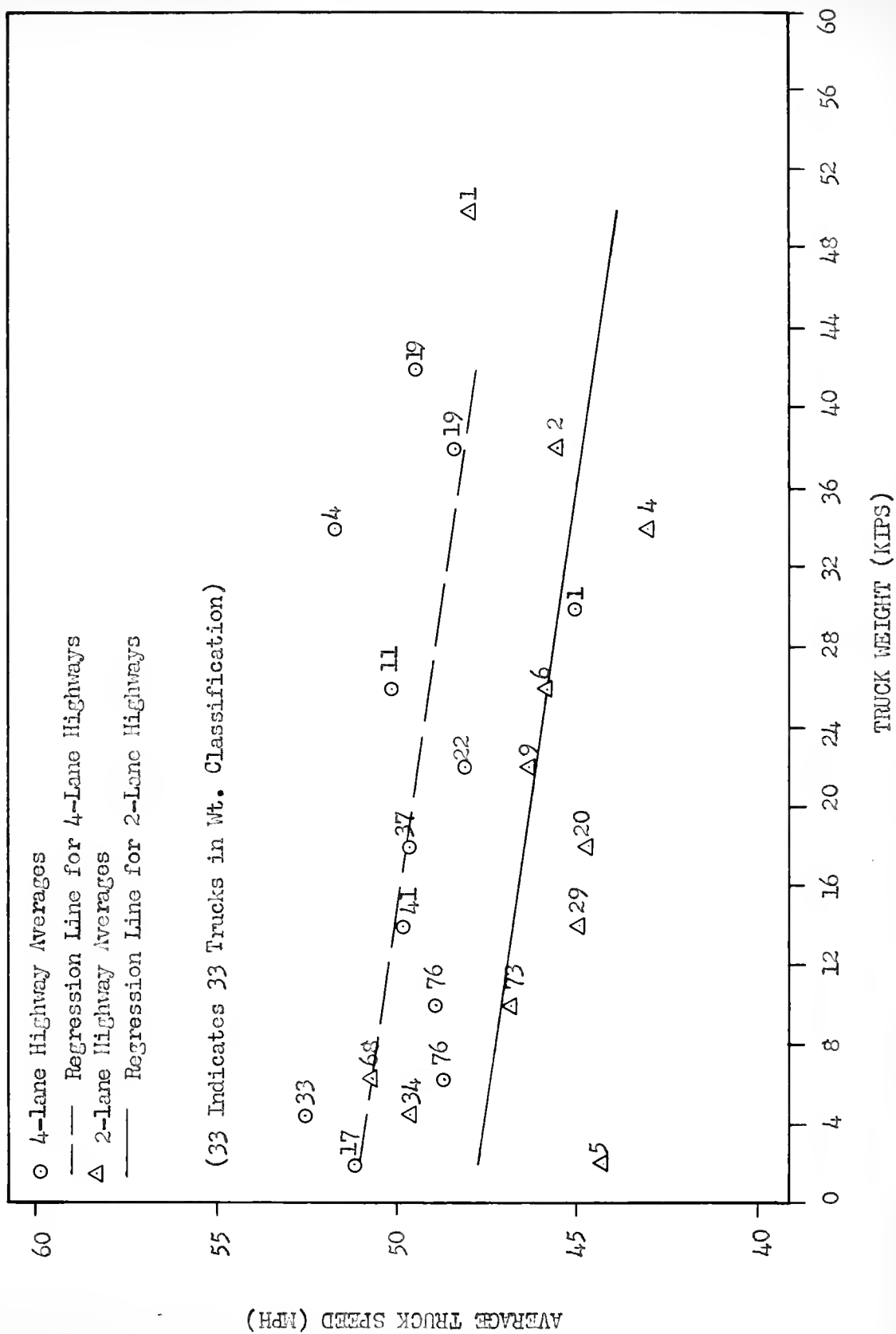


FIGURE 5. AVERAGE TRUCK SPEED FOR TRUCK WEIGHT CLASSIFICATION (SINGLE-UNITS)

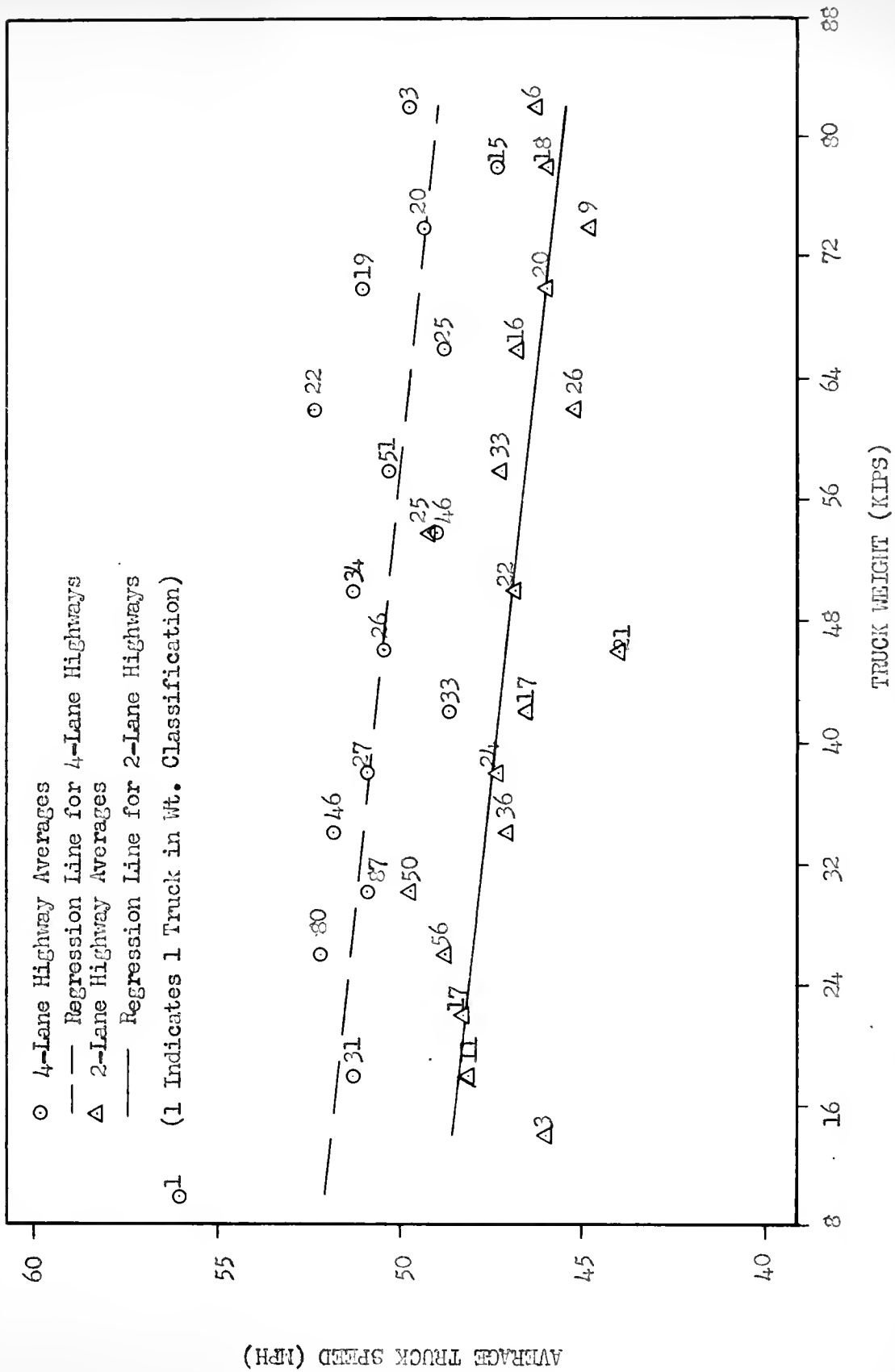


FIGURE 6. AVERAGE TRUCK SPEED FOR TRUCK WEIGHT CLASSIFICATION (MULTI-UNITS)

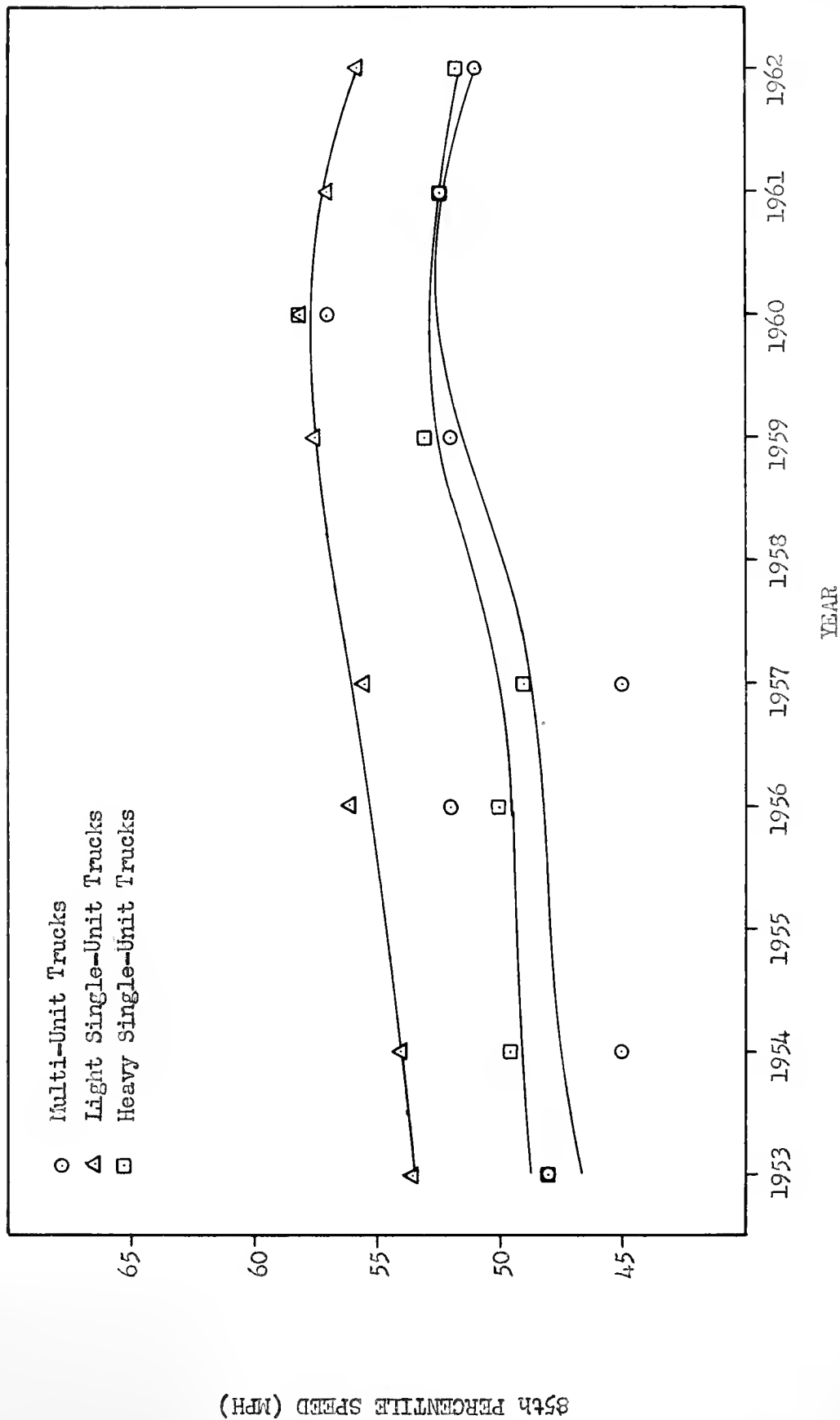


FIGURE 7. TRENDS IN THE 85th PERCENTILE TRUCK SPEED ON TWO-LANE HIGHWAY (1953-1962)

Station	Ave. Speed	75		Total Four-lane		Total Two-lane and Four-lane	
		No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed
0-4	44.3	8	48.3	3	51.1	17	49.5
4-5	55.4	10	50.4	7	5.5	33	51.0
Total trucks		10		50		89	
Ave. wt. (lbs.)	4,400		4,300		4,300		4,400
Ave. speed	52.4		49.8		51.9		50.7
Conf. Level	95%		95%		95%		95%
Conf. Upper	53.3		55.9		54.4		51.0
Limit Lower	57.0		43.7		49.5		47.8
% Empty							
5-8	50.3	34	48.0	5	48.0	70	49.6
8-12	49.5	25	40.7	3	48.9	70	50.0
12-16	47.1	12	50.0	4	49.7	47	47.7
16-20	48.0	7	51.0	1	49.0	37	47.8
20-24	--	8	39.8	4	45.2	22	47.0
24-28	50.0	2	40.0	1	50.1	11	48.0
28-32	--	1	--	--	45.0	1	45.0
32-36	44.0	1	--	--	51.7	4	47.4
36-40	--	4	42.2	2	48.3	19	48.0
40-44	--	1	--	--	50.0	14	48.2
44-48	--	--	--	--	--	--	--
48-52	43.0	--	--	--	--	--	45.0
52-56	--	--	--	--	--	--	--
56-60	--	--	--	--	--	--	--
Total Trucks	5	20		306		521	
Ave. wt. (lbs.)	15,0	16,230		12,900		12,100	
Ave. Speed	49.1	45.9		49.1		43.3	
Conf. Level	95%	95%		95%		95%	
Conf. Upper	50.5	40.9		49.7		47.0	
Limit Lower	47.8	44.9		48.5		47.0	
% Empty							

Station							Total	
	45B	75		Total Four-lane			Two-lane and	Four-lane
Weight (lbs)	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks	Ave. Speed	No. of Trucks
0-10	--	--	--	--	56.0	1	56.0	1
10-15	52.0	1	--	--	66.0	1	51.0	4
16-20	46.5	8	45.0	2	51.2	51	51.0	42
20-24	47.9	15	53.0	1	50.7	69	50.1	116
24-28	51.5	19	--	--	52.1	80	50.8	136
28-32	51.5	22	52.0	1	50.9	87	50.5	137
32-36	50.2	8	46.5	2	51.8	46	49.7	82
36-40	50.1	8	57.0	1	50.7	27	49.1	51
40-44	45.0	11	--	--	48.6	33	47.9	50
44-48	44.0	12	--	--	50.4	26	47.5	47
48-52	49.0	6	--	--	51.2	34	49.5	56
52-56	50.1	13	54.3	3	49.0	40	49.2	71
56-60	50.1	8	45.0	1	50.2	51	49.0	84
60-64	48.4	4	--	--	52.3	22	48.5	48
64-68	50.7	2	--	--	48.7	45	47.9	41
68-72	53.7	1	--	--	51.0	19	48.4	39
72-76	48.5	4	51.0	2	49.3	20	47.9	29
76-80	50.3	4	--	--	47.3	15	46.5	33
80-84	50.0	--	--	--	49.7	3	47.3	9
84-88	--	--	--	--	--	--	--	--
88-92	--	--	--	--	--	--	--	--
92-96	--	--	--	--	--	--	--	--
96-100	--	--	--	--	--	--	--	--
Total Trucks	116		13		638		1079	
Ave. Wt. (lbs.)	41,700		43,400		42,300		42,700	
Ave. Speed	49.		49.5		50.6		49.2	
Conf. Level	95%		95%		95%		95%	
Conf. Upper	50.2		53.4		52.6		49.5	
Conf. Lower	48.9		45.6		48.0		48.9	
% Empty								

TABLE II MULTI-UNIT TRACK SIZES (1PH)

[illegible]

TABLE III

PERCENT OF TRUCKS VIOLATING SPEED LIMITS

Station	Trucks Weighing Under 5000 lbs.				Trucks Weighing Over 5000 lbs.				Multiple Units			
	No. Noted	% Exceed 65 MPH	% Exceed 70 MPH	No. Noted	% Exceed 50 MPH	% Exceed 55 MPH	No. Noted	% Exceed 50 MPH	% Exceed 55 MPH	No. Noted	% Exceed 50 MPH	% Exceed 55 MPH
45-B	15	0	0	52	31.5	7.2	110	46.4	16.4			
5	3	0	0	31	48.4	22.6	198	21.2	4.5			
4	7	0	0	71	29.6	4.9	102	13.1	2.9			
81	14	0	0	61	27.9	6.6	31	3.2	0			
Total	39	0	0	215	28.4	11.2	441	25.5	6.7			
Two-Lane Highways												
2	2	0	0	64	10.9	3.1	137	12.5	0			
14	7	0	0	50	28.0	2.0	200	26.0	4.5			
42	13	15.4	0	77	28.6	10.4	140	22.1	7.1			
58-B	18	0	0	95	10.5	1.1	148	11.5	2.0			
75	10	10.0	10.0	20	5.0	0	13	15.4	7.6			
Total	50	6.0	2.0	306	18.2	3.9	638	23.4	3.6			
Four-Lane Highways												
Summary	89	3.4	1.1	521			1079					

TABLE IV

TRUCK WEIGHT-SPEED DATA
COMPARISON OF DATA FROM STUDIES IN VARIOUS YEARS

Year	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962
Number of Single-Unit Trucks	578	791	1242	1482	1239	905	762	952	1028	837	481	424	938	610
Average Speed of Single-Unit Trucks, mph	42.2	42.4	43.0	43.4	43.9	45.8	45.9	47.0	46.3	46.5	45.5	49.1	48.0	48.7
Average Weight of Single-Unit Trucks, lb.	9,400	8,700	8,600	8,700	8,400	8,000	8,900	8,300	9,400	9,900	9,230	12,000	10,600	11,800
Number of Multiple-Unit Trucks	581	879	1,402	1,354	1,507	1,064	1,120	1,033	1,161	1,130	604	644	1,149	1,079
Average Speed of Multi-Unit Trucks, mph	43.2	42.7	43.5	44.1	43.1	43.6	43.5	44.4	42.5	46.1	48.6	50.3	48.6	49.2
Average Weight of Multi-Unit Trucks, lb.	32,500	36,700	36,700	35,900	35,800	37,400	36,400	37,900	37,100	39,500	40,300	39,300	42,595	42,700

